UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
WASHINGTON, D.C. 20460

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OFFICE OF WATER

MEMORANDUM

SUBJECT: Costs Associated with Regulating Dioxins, Furans, and PCBs in Biosolids

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TO: Alan Hais, Associate Director
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In response to your request, I have developed total cost estimates for the regulation of dioxins, furans, and PCBs in biosolids and I have documented those costs in this memo. In the part 503 regulation, biosolids are referred to as sewage sludge. This memo will document: (1) estimates for the total first year, total second year, and the annual cost of this regulation over subsequent years, (2) a summary of EPA's proposed numerical limit and monitoring requirements, (3) estimates for the number of regulated facilities using land application, (4) estimates for the number of regulated facilities failing the numerical limit, and (5) details for the costs associated with this regulation.

1. Summary of Costs

I developed costs associated with this regulation assuming both a high and a moderate incremental cost at the individual treatment works when changing from the land application of biosolids to co-disposal of biosolids with municipal solid waste. Depending on which costs are used, the first year cost of this regulation across the United States is estimated to be between 17.9 million and 32.3 million in 1998 dollars. Second year costs are between 17.8 and 32.1 million in 1998 dollars. For all subsequent years, the annualized cost of this regulation is estimated to be between 17.1 million and 31.5 million in 1998 dollars.

2. Summary of the Numerical Limit and Monitoring Requirements for Dioxins and PCBs

EPA's proposed regulations differ between large and small facilities. Large facilities include publicly or privately owned treatment works with influent flows to treatment works greater than 1 million gallons per day (MGD) and secondary preparers of biosolids who distribute more than 290

dry metric tons (DMT) of biosolids products per year. Small facilities include publicly or privately owned treatment works with influent flows to treatment works of 1 MGD or less and preparers of biosolids who distribute 290 DMT or less of biosolids products per year.

EPA is proposing a numerical limit and monitoring requirements for large facilities. The numerical limit for dioxins, furans, and PCBs is proposed to be a single number based on the total of all toxic equivalents (TEQs) that relate the cancer risk associated with each congener of dioxin or furan and co-planar of PCB to the cancer risk associated with 2,3,7,8-TCDD. All large facilities seeking approval to land apply biosolids would be required to measure for dioxins, furans, and PCBs in both the first and second years after the proposed regulation goes into effect. In subsequent years, large facilities with total TEQs 30 ppt or less will only be required to measure once every five years for dioxins, furans, and PCBs. Large facilities with total TEQs greater than 300 ppt will not be allowed to land apply their biosolids. Large facilities with total TEQs between 30 ppt and 300 ppt are required to measure for dioxins, furans, and PCBs every year.

EPA is proposing that small facilities, as described above, be exempt from a numerical limit for total dioxins, furans, and PCBs and they are also exempt from monitoring for dioxins, furans, and PCBs. This proposed regulation contains no additional requirements for small facilities.

3. Regulated Facilities using Land Application

Table 1-3 from the *Regulatory Impact Analysis of the Part 503 Sewage Sludge Regulation* (EPA 821-R-93-006), hereafter called the RIA, provides estimates for the number of publicly and privately owned treatment works and quantity of biosolids used or disposed within each of four flow groups. Treatment works with primary, secondary, and advanced treatment are considered here. Estimates from the RIA Table 1-3 are combined with an upper bound estimate for the number of large secondary preparers to produce Table 1 below. The estimated number of large secondary preparers is based on an informal survey of state and Regional biosolids coordinators.

Table 1: Estimated Number of Treatment Works with Primary, Secondary, and Advanced Treatment and Quantity of Biosolids Used or Disposed in 1988 (Dry Metric Tons)		
Reported Flow Rate Group	Number of Facilities	Quantity Used or Disposed (DMT)
> 100 MGD	35	1,532,034
10 - 100 MGD	459	2,128,273
1 - 10 MGD	2,666	1,289,137
≤ 1 MGD	9,588	407,734
Other (Large Preparers)	100	--
Other (Small Preparers)	--	--
Total	12,848	5,357,178

Notes: Numbers may not add due to rounding

-- indicates a value that is not estimated

Source: 1988 National Sewage Sludge Survey, Questionnaire Survey, EPA (secondary and advanced treatment by publicly owned treatment works (POTWs)), and 1988 Needs Survey (primary treatment POTWs).

Table 1-2 from the RIA indicates that roughly one third of all biosolids used or disposed by Publicly Owned Treatment Works (POTWs) that practiced secondary or better wastewater treatment in 1988,were used in land application. Assuming that this percentage also applies to any treatment works that practiced primary wastewater treatment and that the percentage may be applied to numbers of treatment works within flow groups, Table 2 below provides estimates for the number of treatment works and quantity of biosolids associated with land application. Table 2 was developed by dividing treatment works estimates in Table 1 by 3 and rounding. Since land application is the only disposal practice considered here for the regulation of dioxins, furans, and PCBs in biosolids, subsequent tables of impacts and costs will be derived from Table 2.

Table 2: Land Application Only - Estimated Number of Facilities and Quantity of Biosolids Used in 1988 (Dry Metric Tons)		
Reported Flow Rate Group	Number of Facilities	Quantity Used or Disposed (DMT)
> 100 MGD	12	510,678
10 - 100 MGD	153	709,424
1 - 10 MGD	889	429,712

Table 2: Land Application Only - Estimated Number of Facilities and Quantity of Biosolids Used in 1988 (Dry Metric Tons)		
≤ 1 MGD	3,196	135,911
Other (Large Preparers)	100	--
Other (Small Preparers)	--	--
Total	4,350	1,785,725

4. Estimating Facility Failure Rates

I estimated separate failure rates for facilities seeking approval to: (1) land apply biosolids or (2) reduce their monitoring to once in a 5 year period. These failure rates are based on both available data and the numerical limits EPA selected for total TEQs associated with dioxins, furans, and PCBs. As I detail below, failure rate (1) is 5% and failure rate (2) is 37%. The data used here for dioxins and furans were collected during the 1988 National Sewage Sludge Survey (NSSS) and the data used here for co-planar PCBs were collected from POTWs by the Association of Metropolitan Sewage Authorities (AMSA).

Samples for the NSSS were selected using a probability design that allows for the unbiased estimation of dioxin and furan concentrations in biosolids from POTWs that practice secondary or better wastewater treatment. Biosolids from approximately 200 POTWs were selected, sampled, and measured for over 400 analytes, including dioxins, furans, and PCB aroclors. The NSSS did not cover POTWs that only practice primary wastewater treatment, and two thirds of the POTWs covered by the NSSS are not expected to seek approval to practice the land application of biosolids. Measurements for the coplanar PCBs with known TEQs were not collected for the NSSS.

Samples collected by AMSA appear to have been voluntary contributions from approximately 100 POTWs. Measurements for dioxins, furans, and coplanar PCBs were recorded in this survey. These data indicate that biosolids from the same POTW could contain both high levels of dioxins and furans and high levels of co-planar PCBs.

Failure rate (1) is associated with the failure to meet requirements for the land application of biosolids. I have estimated failure rate (1) to be 5% because EPA selected the numerical limit associated with dioxins, furans, and PCBs (300 ppt TEQ) so that approximately 95% of all facilities are expected to have biosolids that contain fewer total TEQs. The 95th percentile for total TEQs was calculated as the sum of: (a) the 95th percentile for TEQs from dioxins and furans summed at individual POTWs as found in the NSSS and (b) the 95th percentile for TEQs from co-planar PCBs as found in the AMSA data.

Failure rate (2) is associated with failure to reduce a facility's monitoring requirements to once in a 5 year period. Such facilities are allowed to land apply biosolids. The total TEQs associated

with their biosolids are between 30 and 300 ppt. Assuming that the total TEQs for dioxins and furans increases with the total TEQs for co-planar PCBs, failure rate (2) for large facilities seeing approval to land apply biosolids is 58%. Conversely, 37 % of large facilities seeking to land apply biosolids are expected to monitor once every 5 years. Given the occurrence of both high total TEQs for dioxins and furans and high total TEQs for co-planar PCBs in the AMSA data, the assumption relating dioxin and furan TEQs to PCB TEQs seems reasonable (See USEPA 1999b).

For a more detailed discussion see *Statistical Support for the Development of Round 2 Biosolids Use or Disposal Regulations,* SAIC, 1999 (USEPA 1999e).

5. Details of Initial and Annual Costs

I have considered two costs, those associated with monitoring and the incremental cost of changing from land application to use of a co-disposal landfill. Since EPA expects secondary preparers of biosolids to change suppliers in cases where biosolids products do not comply with the TEQ limit, EPA expects their disposal costs associated with non-compliance to be essentially zero. EPA estimates the current monitoring cost associated with measuring for dioxins, furans, and PCBs in biosolids to be $2,000 per monitoring event. All large facilities are expected to monitor the first two years and once in each subsequent 5 year period. As estimated above, 58 % of large facilities are expected to monitor annually. I developed high and mid-level incremental costs for changing from land application to co-disposal in a municipal solid waste landfill based on updating incremental costs published in Chapter 4 of the RIA. In 1992 dollars, the highest observed incremental cost for changing from land application to co-disposal in a landfill was $326 per dry metric ton (DMT) and the median observed incremental cost was $170/DMT. Using gross national product to adjust 1992 dollars to 1998 dollars, these incremental costs become $363/DMT and $189/DMT respectively. I selected $363/DMT as the high incremental cost for changing from land application to co-disposal in a landfill and $189/DMT as the mid level incremental cost. I believe that the better of these two estimates for calculating the total cost of this regulation is the mid level (median) cost. I expect the incremental cost at individual facilities to vary randomly about some central tendency (median or mean) cost. In the total cost, I expect the average of these deviations to approximately equal the central tendency value. The high incremental cost is included in this analysis as a reasonable worst case.

Tables 3 and 4 provide details associated with the total first year, total second year, and subsequent annual costs. Calculations associated with each of the column headings are described as follows:

Facilities using Land Application: Transferred from Table 2.

Quantity Land Applied (DMT): Transferred from Table 2.

5% of Facilities that fail limit: Calculated as 5% of the facilities using land application.

Quantity Failing Limit (DMT): Calculated as 5% of the quantity land applied.

Incremental Disposal Cost (1998 Dollars): Calculated as the quantity failing the limit multiplied by the disposal cost per dry metric ton (DMT) indicated at the head of the column.

First Year Cost to Monitor (1998 Dollars): Calculated as the number of facilities using land application multiplied by $2,000 per monitoring event.

Total First Year Costs (1998 Dollars): Calculated as the incremental disposal cost plus the first year cost to monitor.

Second Year Cost to Monitor (1988 Dollars): Calculated as the number of facilities using land application minus the number of facilities that fail the limit, with the result multiplied by $2,000 per monitoring event.

Total Second Year Costs (1998 Dollars): Calculated as the incremental disposal cost plus the second year cost to monitor.

Facilities Monitoring Annually (58%): Calculated as 58% of the facilities using land application.

Average Annual Monitoring Costs for Subsequent Years (1998 Dollars): Calculated as the cost for facilities monitoring annually (58%) plus the cost for facilities that monitor once every five years (37%). Facilities monitoring annually are expected to spend $2,000 per monitoring event. Facilities monitoring once every five years are expected to average $400 per year for monitoring costs.

Average Costs Over Subsequent Years (1998 Dollars): Calculated as the incremental disposal cost plus the average annual cost to monitor for subsequent years.

Table 3: 5% failure rate with high ($363/DMT) incremental disposal costs

Reported Flow Rate Group	Facilities using Land Application	Quantity Land Applied (DMT)	5% of Facilities that fail limit	Quantity Failing Limit (DMT)	Incremental Disposal Cost at $363/DMT (1998 Dollars)	First Year Cost to Monitor (1998 Dollars)	Total First Year Costs (1998 Dollars)	Second Year Cost to Monitor (1988 Dollars)	Total Second Year Costs (1998 Dollars)	Facilities Monitoring Annually (58%)	Average Annual Monitoring Costs for Subsequent Years (1998 Dollars)	Average Costs Over Subsequent Years (1998 Dollars)
> 100 MGD	12	510,678	1	25,534	$9,268,806	$24,000	$9,292,806	$22,000	$9,290,806	7	$15,696	$9,284,502
10 - 100 MGD	153	709,424	8	35,471	$12,876,046	$306,000	$13,182,046	$290,000	$13,166,046	89	$200,124	$13,076,170
1 - 10 MGD	889	429,712	44	21,486	$7,799,418	$1,778,000	$9,577,418	$1,690,000	$9,489,418	516	$1,162,812	$8,962,230
≤ 1 MGD	3,196	135,911	0	0	$0	$0	$0	$0	$0	0	$0	$0
Other (Large Preparers)	100	--	5	--	--	$200,000	$200,000	$200,000	$200,000	58	$130,800	$130,800
Other (Small Preparers)	--	--	0	0	$0	$0	$0	$0	$0	0	$0	$0
Total	4,350	1,785,725	58	82,491	$29,944,269	$2,308,000	$32,252,269	$2,202,000	$32,146,270	670	$1,509,432	$31,453,701

Table 4: 5% failure rate with mid level ($189/DMT) incremental disposal costs

Reported Flow Rate Group	Facilities using Land Application	Quantity Land Applied (DMT)	5% of Facilities that fail limit	Quantity Failing Limit (DMT)	Incremental Disposal Cost at $189/DMT (1998 Dollars)	First Year Cost to Monitor (1998 Dollars)	Total First Year Costs (1998 Dollars)	Second Year Cost to Monitor (1988 Dollars)	Total Second Year Costs (1998 Dollars)	Facilities Monitoring Annually (58%)	Average Annual Monitoring Costs for Subsequent Years (1998 Dollars)	Average Costs Over Subsequent Years (1998 Dollars)
> 100 MGD	12	510,678	1	25,534	$4,825,907	$24,000	$4,849,907	$22,000	$4,847,907	7	$15,696	$4,841,603
10 - 100 MGD	153	709,424	8	35,471	$6,704,057	$306,000	$7,010,057	$290,000	$6,994,057	89	$200,124	$6,904,181
1 - 10 MGD	889	429,712	44	21,486	$4,060,854	$1,778,000	$5,838,854	$1,690,000	$5,750,854	516	$1,162,812	$5,223,666
≤ 1 MGD	3,196	135,911	0	0	$0	$0	$0	$0	$0	0	$0	$0
Other (Large Preparers)	100	--	5	--	--	$200,000	$200,000	$200,000	$200,000	58	$130,800	$130,800
Other (Small Preparers)	--	--	0	0	$0	$0	$0	$0	$0	0	$0	$0
Total	4,350	1,785,725	58	82,491	$15,590,818	$2,308,000	$17,898,818	$2,202,000	$17,792,818	670	$1,509,432	$17,100,250